Foreword

National Oceanic and Atmospheric Administration

U.S. DEPARTMENT OF COMMERCE

NOAA Fisheries Service
Northeast Cooperative Research Partners Program

The National Marine Fisheries Service (NOAA Fisheries Service), Northeast Cooperative Research Partners Program (NCRPP) was initiated in 1999. The goals of this program are to enhance the data upon which fishery management decisions are made as well as to improve communication and collaboration among commercial fishery participants, scientists and fishery managers. NOAA Fisheries Service works in close collaboration with the New England Fishery Management Council's Research Steering Committee to set research priorities to meet management information needs.

Fishery management is, by nature, a multiple year endeavor which requires a time series of fishery dependent and independent information. Additionally, there are needs for immediate short-term biological, oceanographic, social, economic and habitat information to help resolve fishery management issues. Thus, the program established two avenues to pursue cooperative research through longer and short-term projects. First, short-term research projects are funded annually through competitive contracts. Second, three longer-term collaborative research projects were developed. These projects include: 1) a pilot study fleet (fishery dependent data); 2) a pilot industry based survey (fishery independent data); and 3) groundfish tagging (stock structure, movements and mixing, and biological data).

> First, a number of short-term research projects have been developed to work primarily on commercial fishing gear modifications, improve selectivity of catch on directed species, reduce bycatch, and study habitat reactions to mobile and fixed fishing gear.
>
> Second, two cooperative research fleets have been established to collect detailed fishery dependent and independent information from commercial fishing vessels. The original concept, developed by the Canadians, referred to these as "sentinel fleets". In the New England groundfish setting it is more appropriate to consider two industry research fleets. A pilot industry-based survey fleet (fishery independent) and a pilot commercial study fleet (fishery dependent) have been developed.
>
> Additionally, extensive tagging programs are being conducted on a number of groundfish species to collect information on migrations and movements of fish, identify localized or subregional stocks, and collect biological and demographic information on these species.

For further information on the Cooperative Research Partners Programs please contact:

National Marine Fisheries Service (NOAA Fisheries Service)
Northeast Cooperative Research Partners Program

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(401) 782-3323 – Northeast Fisheries Science Center, Cooperative Research Office, Narragansett Laboratory

www.nero.noaa.gov/StateFedOff/coopresearch/

Final Report

Fall 2002 and Spring 2003
Maine – New Hampshire
Inshore
Trawl Survey

Submitted to the NOAA Fisheries-Northeast Region,
Cooperative Research Partners Initiative
(Contract #NA16FL2259)

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MEDMR Research Reference Document 04/02

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Logistically, this was a complex project that benefited from the assistance of many people. Without their help, the survey could not have been completed. Forgive us for inevitably overlooking others who provided support.

We would like to thank Maine DMR staff that helped with mailings, car shuttles, and contributed to the data collection and entry. We appreciate the hard work put in by the commercial boat crews. F/V Robert Michael crewmembers Captain Curt Rice, Dale Doucette, and Jerry Balzano, as well as shore engineer, Randy Greenleaf, all were most helpful, professional and enjoyable to work with. Jeff Flagg, and Danny Libby provided invaluable dockside assistance throughout the coast by transporting nets and parts to keep the survey running. Science crewmembers included Karina Jolles, Matt Carpenter, Kevin Sullivan, Sherry White, George Lapointe, Mary Costigan, and Lisa Pinkham. We are especially grateful for support from Colonel Joe Fessenden, Lieutenants Dave Mercier, and Alan Talbot and some 20 Marine Patrol Officers who helped both on and off the water, handling gear, helping to communicate with lobstermen, and whose presence added to our security. We express many thanks to all of the facilities along the coast that provided dockage for the survey vessels. Alison Ferreira successfully assisted us through our federal permitting process. Professor Yong Chen helped us conceptualize and refine our original sampling design. Terry Stockwell, Sarah Cotnoir, Linda Mercer, Carl Wilson, and Dan Schick helped with all aspects of the project providing technical guidance, field assistance, and general advice.

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Lastly, we appreciate the support and cooperation of those fixed gear fishermen throughout the survey area that moved gear and suggested alternative sites when necessary. We also would like to thank those who participated in the survey as onboard observers. The Lobster Zone Councils, Maine Lobster Advisory Council, Maine Lobstermen's Association, and Downeast Lobstermen's Association provided many comments, and suggestions to help minimize gear conflicts and improve cooperation.

EXECUTIVE SUMMARY

This report summarizes the third year of a comprehensive bottom trawl survey of groundfish and other species for Maine-New Hampshire's inshore waters. This survey continues to establish the time series to be utilized for long term monitoring of inshore stocks of the Gulf of Maine. Funds set aside by Congress to assist groundfishermen were administered and distributed through the Cooperative Research Partners Initiative of the National Marine Fisheries Service with the goal of fostering research partnerships between commercial fishermen and scientists.

This survey is intended to compliment similar surveys conducted by the National Marine Fisheries Service in the outer waters of the Gulf of Maine and surveys conducted by other Atlantic coast states in their inshore waters. Prior to this survey, no fishery independent information has been available for approximately 80% of the U.S. Gulf of Maine's inshore waters. The survey utilizes newly designed research nets and two nearly identical commercial fishing vessels to complete approximately 100 trawls in spring and fall for a total of 50 days at sea.

This report highlights findings of the third year and discusses comparisons with the previous years. In-depth analysis of data is premature. In fact, it will be several years before a time series will be developed to use in stock assessment models.

Trawl survey data has a wide array of uses beyond groundfish stock assessments. In truth, this is a multispecies survey that provides broad information on finfish and invertebrate populations and communities that can contribute to how we manage our marine environments.

INTRODUCTION

The Maine-New Hampshire inshore trawl survey is a collaborative partnership between commercial fishermen and researchers to assess inshore fish stocks along the Maine and New Hampshire coasts. The project was funded through the National Marine Fisheries Service's Cooperative Research Partners Initiative. Collaborative research enables fishermen to contribute their knowledge and experience toward the process of scientific data collection and ultimately to resource management decisions. It also strengthens the trust between fisherman and scientists.

Fishery-independent trawl surveys are a well-established and accepted method of developing relative abundance indices for fishery resources (Gosslein, 1969). They reflect changes in true abundances of fish populations whereas commercial fishing practices change in response to market demand, fish availability, regulations and fishing power as technological improvements in commercial trawls and fish detection gear are made. Abundance indices derived from research trawl surveys that maintain consistent and standardized efforts are largely free of these biases. Trawl surveys are synoptic investigations that provide comprehensive information on distribution and abundance of all types and sizes of organisms within towable survey areas. Knowledge of distribution and abundance of juvenile (pre-commercial) fish is critical to the study of recruitment and for predicting future abundance.

Information about population sizes, instantaneous recruitment and mortality rates, trends, and distributions is essential for effective management of any resource. Such knowledge is critical to understanding both the dynamics and the condition of that resource. The lack of survey data from large areas of the Gulf of Maine has led to significant gaps in information needed to assess current stock conditions and develop effective management strategies. This project continues last year's effort to monitor inshore fish stocks and fill the inshore information gap.

Surveying the inshore waters of Maine and New Hampshire has been a long-standing challenge. The rough terrain that characterizes the bottom of the nearshore areas of northern Gulf of Maine along with the great quantity of fixed gear in inshore waters limits the number of tows that can be made. Even today, the National Marine Fisheries Service (NMFS), with its large survey vessels, surveys very few stations nearshore (< 50 fm), due in part to the nature of Maine's coast and proliferation of fixed gear. Past efforts to survey fish stocks in the Gulf of Maine focused heavily on offshore areas. Spring and fall bottom trawl surveys for finfish resources have been conducted along the inshore and offshore continental shelf waters from Cape Hatteras, NC to Cape Cod, MA, including the offshore Gulf of Maine, by the NMFS since 1963. In contrast, New Hampshire and Maine inshore waters, which comprise the bulk of the known spawning and nursery areas for the Gulf of Maine, (Rich, 1929; Bigelow and Schroeder, 1953) have not been continuously sampled. A comparable time series does not exist for these areas.

The coverage this survey provides promises to be very valuable to the understanding of marine ecosystems in the Gulf of Maine. We are confident that the northern inshore Gulf of Maine can be successfully and consistently sampled via trawl survey indefinitely, with sustained funding.

Objective

The overall goal of this project is to establish a solid foundation for a long-term fishery independent monitoring program in Maine and New Hampshire's inshore waters (5-80^{+} fathoms).

Specific objectives are:

- to document the distribution and relative abundance of marine resources in the nearshore Gulf of Maine
- to improve survey logistics to gain cooperation of the fixed gear fishermen
- to develop recruitment indices for assessments of target species
- to involve fishermen in scientific data collection
- to collect environmental data, including temperature and salinity, that affect fish distribution
- to collect ichthyoplankton samples along the coasts to identify timing of finfish spawning
- to gather information on biological parameters (growth rates and reproduction)

MATERIALS AND METHODS

Station Selection – Randomization

The ME/NH Inshore Trawl Survey is a stratified random survey with a fixed component. In the spring of 2003 a fourth stratum was added to the area sampled increasing it from ~3626 square nautical miles (NM^2) to ~4665 NM^2. This new stratum overlaps the NMFS trawl survey area to provide some ability to compare the ME/NH Survey to that of NMFS. The area is now divided into 20 strata consisting of four depth strata: 5-20 fathoms, 21-35 fathoms, 36-55 fathoms, greater than 56 fathoms (its outer boundary roughly delineated by the 12-mile limit), and 5 regions based on oceanographic, geologic, and biological features. In order to keep the sampling density of the original strata roughly equivalent with previous surveys, an additional 15 stations were added. The number of stations per stratum is allocated in proportion to each stratum's area (Table 1.). The survey now targets 115 tows per season. Of those, 40 are fixed stations distributed evenly at two per strata and the remaining 75 allocated according to strata area and are selected randomly. Due to various problems, fixed gear interaction, untowable bottom, weather, and time constraints, we were never able to achieve the optimal sample size. The original goal of 100 stations per survey gives a sampling density of 1 station for every 36 NM^2; on average we accomplished a density of 1 in 40 NM^2. By adding 15 stations to our goal, we strive for a density of 1 tow every 40 NM^2.

Random stations are selected from a NOAA nautical chart in Arc View ™ GIS overlain with 1-NM^2 grids. Each grid within each region is assigned a unique identification number that serves as a call number. Grids are selected using an Excel ™ random number generator. Tows approximately 1 NM long are proposed in each grid and plotted in PC Windplot ™. From prior experience and local knowledge, some grids are classified as untowable during the plotting process. Due to the excessive fixed gear and the request of fishermen to cooperate with the survey by clearing the tows, having good tow locations is a priority. If no towable bottom can be found within a 2-mile radius, a new random number is chosen within the same stratum. GPS

latitude and longitude and Loran C co-ordinates for the tows are recorded from this program and plotted in Arc View ^{TM} GIS to check the coordinates and locations

Table 1. Area in square miles of the 20 strata of the ME/NH Trawl Survey

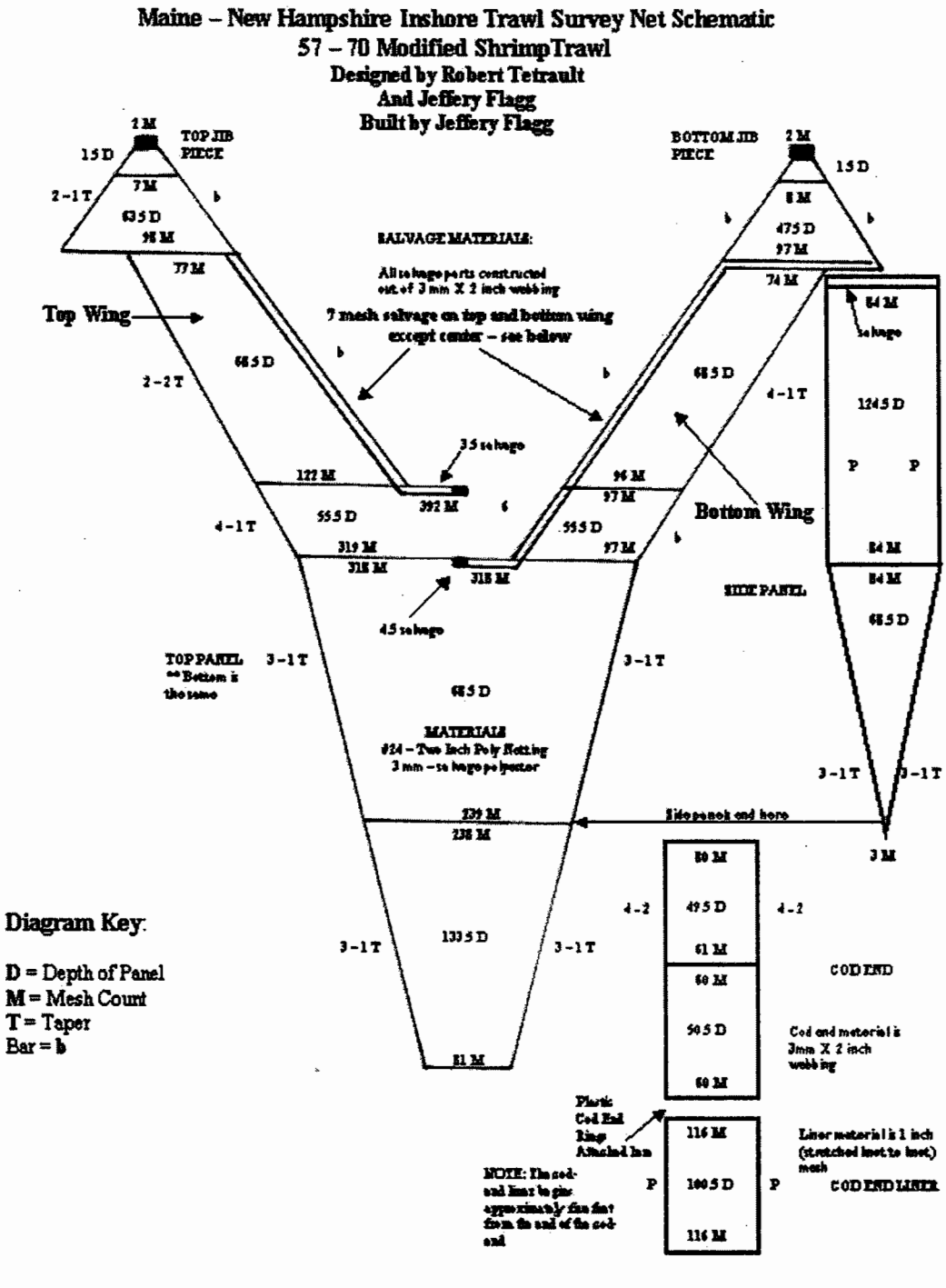
Region	5-20 fathoms	21-35 fathoms	36-55 fathoms	>56 fathoms	Total
1	253.27	214.22	227.35	225.65	920.50
2	279.63	191.23	211.66	263.49	946.02
3	259.62	262.90	280.03	183.69	986.25
4	205.30	206.12	310.49	170.72	892.63
5	138.54	220.49	365.04	196.11	920.19
Total	1136.37	1094.96	1394.59	1039.66	4665.58

Vessels

Two virtually identical commercial fishing vessels, the F/V Tara Lynn and F/V Robert Michael, were used for the survey. Both vessels are Down East 54's constructed of solid fiberglass with full displacement hulls taken from the same mould. They are powered by 8-cylinder GMC diesel engines producing 325 H.P. Reverse gear is a twin disk and a 3-in. stainless steel shaft turns a 4-bladed power propeller housed in a nozzle. The vessel's hull displacement is 73-gross tons allowing it to perform well in sea states up to eight feet. While only one vessel at a time was planned for each survey, in the event of an equipment breakdown, the other could be made immediately available so that the survey could be completed on schedule.

Net

Design considerations for the survey included effectiveness of the gear for sampling the complex bottom in the nearshore areas of the Gulf of Maine and comparability with previous and ongoing surveys by NMFS and Massachusetts Division of Marine Fisheries. The net is a modified version of the shrimp net design used in Maine waters (Figure 1) and fishes effectively for a variety of near-bottom dwelling species, not targeting any specific component.



Note: Previous annual reports contained incorrect net specifications. The actual net has remained consistent since the beginning of the survey in 2000.

Figure 1. Net Design for the Maine – New Hampshire Inshore Trawl

Net tapers permit the shape of the net to achieve maximum height while allowing the net to remain tight on the bottom. The net is shackled from the footrope to the frame using two 3/8-inch shackles to a banded wire that runs parallel with the footrope. Heavy rubber wing bobbins retard bottom wing lift. The top leg is 7/16th inch wire, 60 feet long with pipe thimbles at either end, and the bottom leg is 5/8th inch wire 58 feet long with two feet of 5/8th inch chain at the end where the leg attaches to the bottom wing. The bottom leg is covered with 2 3/8th inch cookies to prevent them from digging into mud. The net is constructed of 2 inch #24 polyethylene mesh overall with a 1-inch (stretched measure) mesh liner in the cod end. Doors are #7.5 Bison's. Attached to the 70 ft. 5/8" Rander's Combination Wire Rope footrope, is a roller frame strung onto ¾" 6 x 19 round strand wire. Ten feet of 8 inch cookies @ 6" apart with eight toggles in the middle are in the bosom of this sweep with 29' of 6 inch cookies @ 4.5" apart with 12 toggles strung up each wing with 4" cookies in between each larger cookie on entire frame. On the headrope are twenty-eight, 8" center hole plastic floats attached to the 5/8" inch Rander's Combination Wire Rope headline with 5/8" yellow polyethylene float line. Between surveys, the net is sent back to the manufacturer where it is returned to specification. Before each survey, all nets are again measured for consistency and adjusted/repaired as needed. Trawl wires on the vessel are also measured prior to each survey.

Prior to the initial fall 2000 survey, side-by-side comparison tows between the survey net and a commercial net resulted in comparable relative proportions of species caught. To advance knowledge of gear performance, in 2002 and 2003, Massachusetts Division of Marine Fisheries staff assisted for on two occasions using net mensuration sonar and cameras.

Public Notification

Due to the extensive fixed gear fisheries in the coastal waters of Maine and New Hampshire, an inshore trawl survey must coordinate with these fishermen. Prior to each survey, mailings containing the survey's daily schedule and tow locations were sent to about 6,500 Class I, II and III lobster license holders. MEDMR maintained a toll free hot line for commercial fishermen to request additional information or voice concerns, a web site with the daily schedule, tow coordinates, and chart of tows. In addition, NOAA's National Weather Service's offices in Gray and Caribou broadcast daily-recorded messages containing weekly schedule and contact information.

Sample Collection (Towing)

Before each tow, at least one pass, and often two passes, was made along each planned towline to survey for fixed gear and bottom conditions. The target for tow duration is 20 minutes at a speed of 2.2-2.3 knots to cover about 0.8 NM. Start and end location (Loran C co-ordinates, GPS latitude and longitude), time, depth, tow direction, and tow duration were recorded for each tow. Setting of the winch brakes identified the start of tow duration and the end was marked at the start of the winches to retrieve the net. Bottom temperatures and salinities were collected at each station for using a SeaBird Model SBE 19-plus CTD. Other environmental data including wind, sea state, and weather were also recorded at each station. All tows were conducted during

daylight hours. When a station is encountered that cannot be towed, an alternate tow is searched for while proceeding to the next site.

Handling Catch

After each tow, the net was brought aboard and emptied onto a sorting table. All individuals were identified and sorted by species. Lobsters were separated and processed as the rest of the catch was sorted. Total weights (by sex), carapace length (mm), shell condition, presence and stage of eggs, V-notch condition, and trawl damage were recorded. After processing, lobsters were carefully placed in baskets to minimize damage. Larger individuals were kept separate. Baskets were weighed and the lobsters were returned alive to the sea. Similarly, care was taken to immediately separate, measure, weigh and release alive any marine specimens.

Finfish lengths were measured as total central length to the nearest centimeter, except those with heterocercal caudal fins, such as dogfish and sturgeon. Dogfish and all sturgeon are consistently measured to the nearest centimeter at the terminus of the upper caudal lobe. Crabs were measured using carapace width (cm). Scallops were measured using the width (cm) of the shell. Other bivalves were measured using the length (cm) of the shell. Squid were measured using mantle length (cm). Shrimp species are weighed in aggregate. Mixed shrimp are separated by species, an aggregate weight and count is taken for each species during the sub-sample. A 1-kilogram sub-sample is sufficient. All other invertebrates were enumerated. Aggregate weights were taken for all species. When catches were large (i.e. > ~200 individuals) a sub-sample of at least 100 representative individuals was taken, measured and weighed. Total catch statistics were then expanded based on the total catch weight. Lobsters were not routinely sub-sampled but rather all individuals were measured.

In the spring 2003 survey, additional biological data were collected, including individual weights, sex, and maturity for selected groundfish species using the methods described in Burnett *et al,* 1989. Fish examined were designated as immature, developing, ripe, ripe/running, spent, or resting. When possible, all individuals selected were examined; a sub-sample was taken if the catch of a particular species was large. Otoliths were collected for winter flounder.

Ichthyoplankton Tows

Ichthyoplankton tows were conducted in the spring 2002 and spring 2003 surveys. All samples were collected with a 1-meter plankton net of 333 μm mesh. A General Oceanics flow meter was attached to the mouth of the plankton net to determine the amount of water filtered by the net for each tow. The net was towed for fifteen minutes in a stepped oblique fashion at a speed of less than 2 knots for five minutes below the surface, five minutes at 10 m below the surface, and five minutes at 20 m below the surface. Upon haul back, the contents of the net were emptied into a 1L container while rinsing the end of the net. Samples were preserved in 10% formalin for later identification by the Atlantic Reference Centre of the Huntsman Marine Lab.

Analysis and Presentation of Data

For the purposes of this report, which is to provide a very general overview, data from both the stratified random and fixed components of the survey were analyzed together. All data presented in bar graphs are arithmetic mean number of individuals caught per standard 20-minute tow. Error bars (when shown) are standard errors of that mean. All length frequency graphs are total number at length, expanded from sub-samples when necessary. Bubble plot distributions portray number of individuals caught per station. Stratified means and errors reported in Appendix B were calculated utilizing the same formulas reported for the NMFS' SURVAN formulas.

Release of Data

In response to concerns expressed by Maine's fishing communities, we have developed a policy on the release of raw data collected from individual tows (see Appendix D).
In summary,

1) provisional data will not be released to the public
2) tow specific lobster data will be held for one year before release
3) exceptions are permitted where management and regulatory decisions may benefit

RESULTS

ME/NH SURVEY--------The first 3 years

Catches for the survey were fairly consistent from year to year but more variable seasonally. Spiny dogfish, lobster, red, white, and silver hake are more abundant in the fall (Table 2). Occurrence of white hake increased two-fold in the fall (Table 3). Abundance of American plaice and the Pandalid shrimp species increased in the spring. Although sea cucumbers are relatively uncommon in catches (Table 3), they rank in the top 10 the spring surveys (Table 2).

Table 2. Ranking of the top 10 species by weight and number separated by season from fall 2000 through spring 2003

Fall 2000		Fall 2001		Fall 2002	
Wt. (kg)	Number	Wt. (kg)	Number	Wt. (kg)	Number
Silver hake	Herring	Silver hake	Silver hake	Lobster	Mixed shrimp
Lobster	Silver hake	Lobster	Herring	Dogfish	Herring
Herring	Mixed shrimp	Herring	Mixed shrimp	Silver hake	Silver hake
Dogfish	Alewife	Dogfish	Alewife	Herring	Alewife
Alewife	Lobster	Monkfish	Lobster	Alewife	Lobster
Winter flounder	Rainbow smelt	Alewife	Rainbow smelt	Longhorn sculpin	Longhorn sculpin
Red hake	Sea scallop	Red hake	Red hake	Monkfish	Butterfish
Longhorn sculpin	Winter flounder	White hake	Witch flounder	Red hake	Menhaden
Monkfish	Red hake	Witch flounder	Sea scallop	Winter flounder	Winter flounder
White hake	Longhorn sculpin	Jonah crab	American plaice	White hake	Rainbow smelt

Spring 2001		Spring 2002		Spring 2003	
Wt. (kg)	**Number**	**Wt. (kg)**	**Number**	**Wt. (kg)**	**Number**
Herring	Mixed shrimp	Herring	Euphausids	Herring	Herring
Lobster	Herring	Lobster	Herring	Lobster	Mixed shrimp
Longhorn sculpin	Alewife	Silver hake	Mixed shrimp	Silver hake	Silver hake
Sea cucumber	Silver hake	Longhorn sculpin	Silver hake	Mixed shrimp	Alewife
Silver hake	Blueback herring	American plaice	Alewife	Longhorn sculpin	American plaice
Winter flounder	Longhorn sculpin	Alewife	Lobster	American plaice	Euphausids
Alewife	Lobster	Atlantic cod	Longhorn sculpin	Alewife	Longhorn sculpin
Mixed shrimp	Sea scallop	Winter flounder	American plaice	Winter flounder	Lobster
American plaice	Winter flounder	Mixed shrimp	Winter flounder	Atlantic cod	Blueback herring
Sea scallop	American plaice	Sea cucumber	Sea scallop	Sea cucumber	Winter flounder

Table 3. Percent occurrence of selected commercially important species for accumulative spring and fall surveys

Species	Fall	Spring	Species	Fall	Spring
	%	%		%	%
Silver Hake	93.59	83.01	Sea Scallop	46.79	45.10
American Lobster	91.67	92.81	Witch Flounder	41.03	28.76
White Hake	89.10	41.18	Northern Shrimp	39.42	49.35
Winter Flounder	85.58	91.18	Atlantic Mackerel	38.78	0.65
Alewife	84.94	90.20	Rock Crab	38.78	48.37
Atlantic Herring	83.65	81.70	Acadian Redfish	37.18	34.31
Longhorn Sculpin	78.85	88.24	Little Skate	36.86	31.05
Red Hake	73.72	77.12	Haddock	36.22	19.61
Goosefish	65.38	54.25	Shortfin Squid	35.26	1.31
Jonah Crab	63.46	52.29	Pollock	27.24	23.86
Butterfish	60.58	1.63	Rainbow Smelt	26.92	18.30
American Plaice	58.01	68.63	Yellowtail Flounder	23.08	31.05
Windowpane flounder	58.01	51.63	American Shad	17.63	36.93
Atlantic Cod	55.77	50.00	Scup	17.31	
Spiny Dogfish	49.68	3.27	Ocean Pout	8.33	18.30
Longfin Squid	49.04	8.17	Sea Cucumber	6.41	9.15

FALL 2002 SUMMARY

Completing the survey in the fall season with the profusion of lobster gear continues to be a challenge. The fall survey began on October 14, 2002, two weeks later than the previous fall survey to gain cooperation from eastern fixed gear fishermen. Although this resulted in somewhat decreased cooperation in the mid-coast area, we were able to complete 81 out of 100 targeted tows. The volume of total mixed catch varied from a minimum of about 12 kg to a maximum of about 513 kg averaging about 140 kg. The total number of species caught was 90 with a low of 9 and a high of 34 in any particular tow with the average number of species 22. Top ten rankings by species density can be found in Table 2.

Average bottom temperatures by stratum ranged from 12.7 to 8.8 °C (Table 4.). The overall average temperature for 2002 was 10.5 °C, compared to 9.5 °C for 2000 and 10.2 °C for 2001.

Table 4. Average bottom temperatures (°C) for the Fall 2002 survey.

		Region				
		1	2	3	4	5
Stratum	1	12.7	11.8	11.4	8.8	9.4
	2	11.2	11.2	11.2	9.7	9.5
	3	9.0	10.3	11.1	10.6	9.7

Some similar species were encountered in the fall of 2002 as those seen in 2000, but not in the fall of 2001. Menhaden were present in the fall 2000 survey and not present at all in fall 2001. In the fall 2002 survey, menhaden were present in numbers approximately three times that of 2000 (Figure 2).

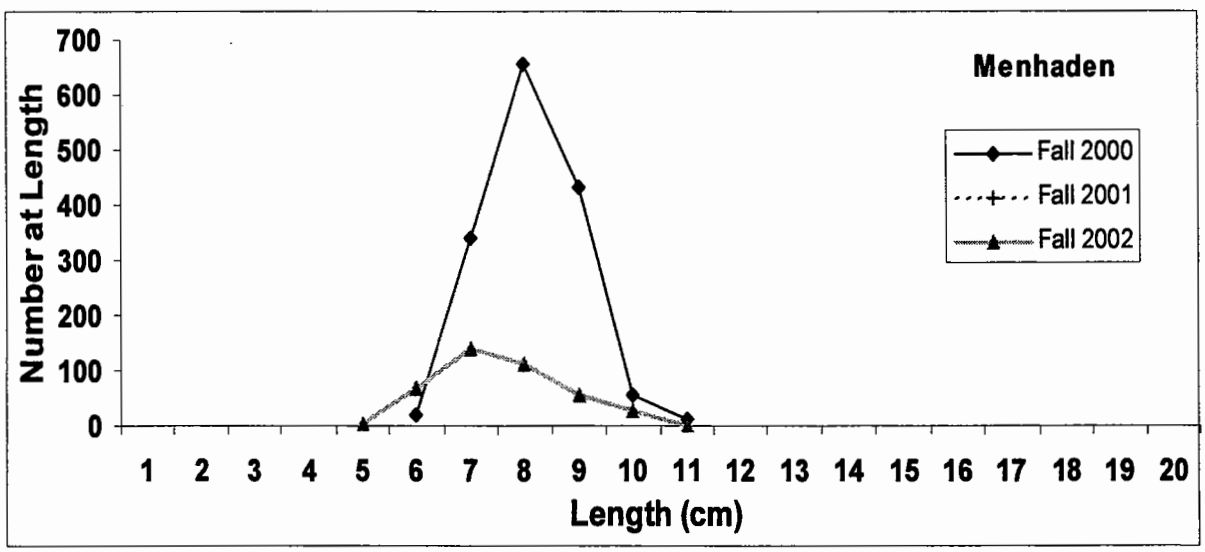


Figure 2. Length frequencies for menhaden measured in the fall surveys

Atlantic Moonfish, rarely seen in the Gulf of Maine, were found for the first time in the survey along southwestern Maine and New Hampshire. Thirty-five individuals were caught in one location in Casco Bay (see Appendix C).

Butterfish were considerably more abundant in the southern two regions, New Hampshire to Penobscot Bay, than the previous two fall surveys (Figure 3.).

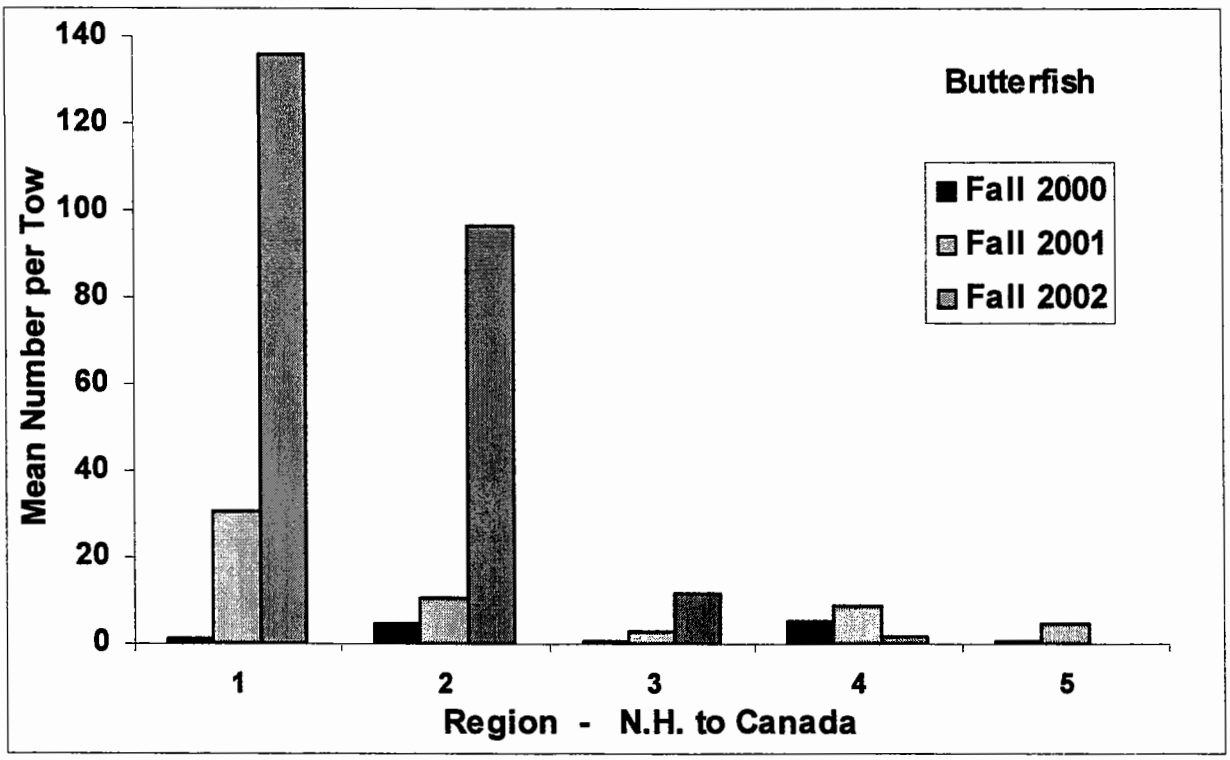


Figure 3. Mean number of butterfish per 20-minute tow for each region along the coasts of Maine and New Hampshire

Scup were also present in the fall of 2000 and 2002, but not 2001. Scup abundance was greater in 2000 and a larger number of adult fish were encountered (Figure 4.).

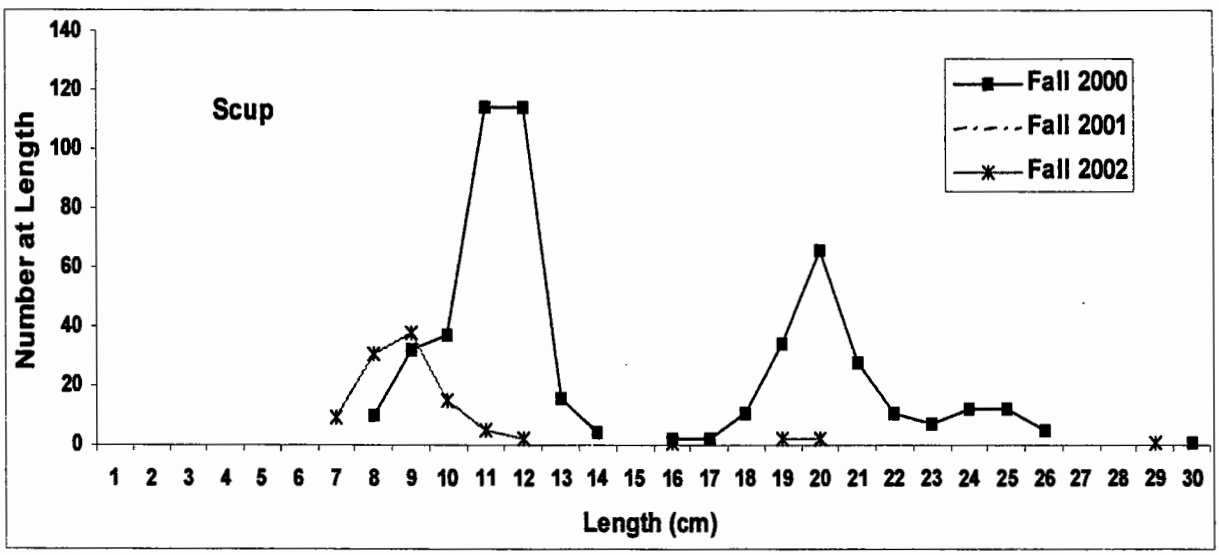


Figure 4. Length frequencies for total scup measured in the fall surveys.

Juvenile short bigeyes were seen in a tow inside Casco Bay and two more near Seal Is. in Penobscot Bay (see Appendix C.). Another live specimen was brought into the lab earlier in the summer of 2002. We believe this is the first occurrence of this species along the Maine coast

SPRING 2003 SUMMARY

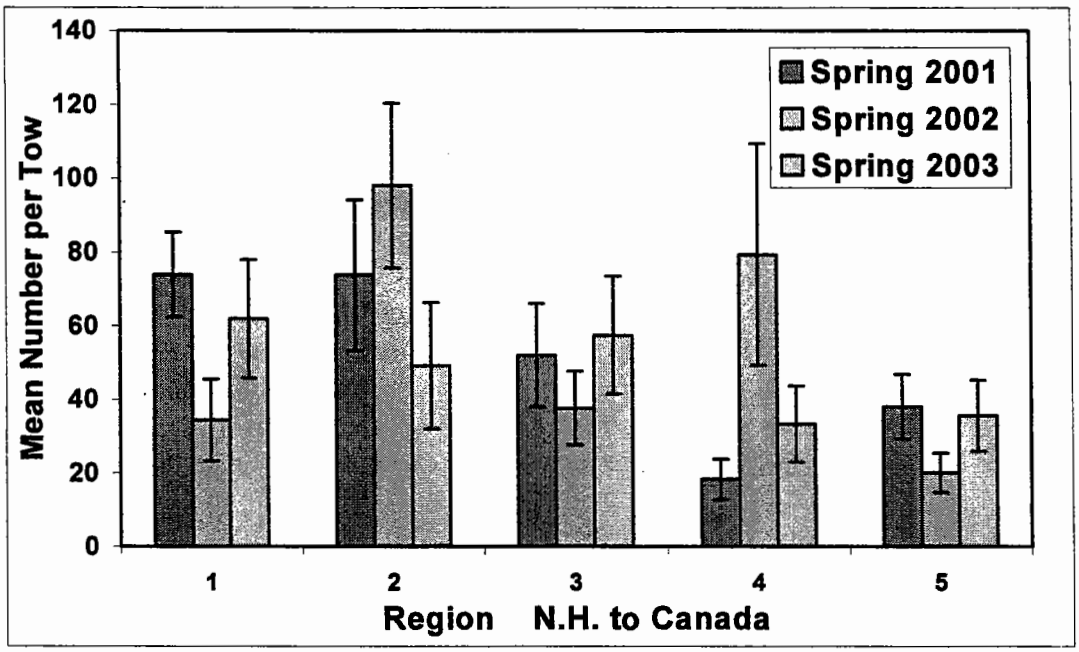
The spring survey began on May 5, 2003 along the coast of New Hampshire. 101 out of a proposed 115 tows were completed in this survey. The weight of the total mixed catch varied from 549 kg to 13 kg with an average of 102 kg. Total number of species caught during the spring survey was 87. Species richness per tow ranged from 11 to 32 with an average richness of 21. The top ten species by number and weight can be found in Table 4.

Average bottom temperatures by stratum ranged from 6.6 to 3.3 °C (Table 5.). The overall average temperature for 2002 was 4.6 °C, compared to 4.1 °C for 2001 and 6.1 °C for 2002.

Table 5. Average bottom temperatures (°C) for the Spring 2003 survey.

		Region				
		1	2	3	4	5
Stratum	1	4.9	3.6	4.7	6.6	5.9
	2	3.4	4.6	4.3	5.2	5.4
	3	3.3	3.7	4.3	4.9	5.4
	4	3.5	3.5	3.9	5.5	6.5

Based on previous work conducted by the MEDMR, longhorn sculpin were generally thought to be more abundant in the spring. Results from the spring survey support this, but only in the southwestern portion of the coast (Figure 5).



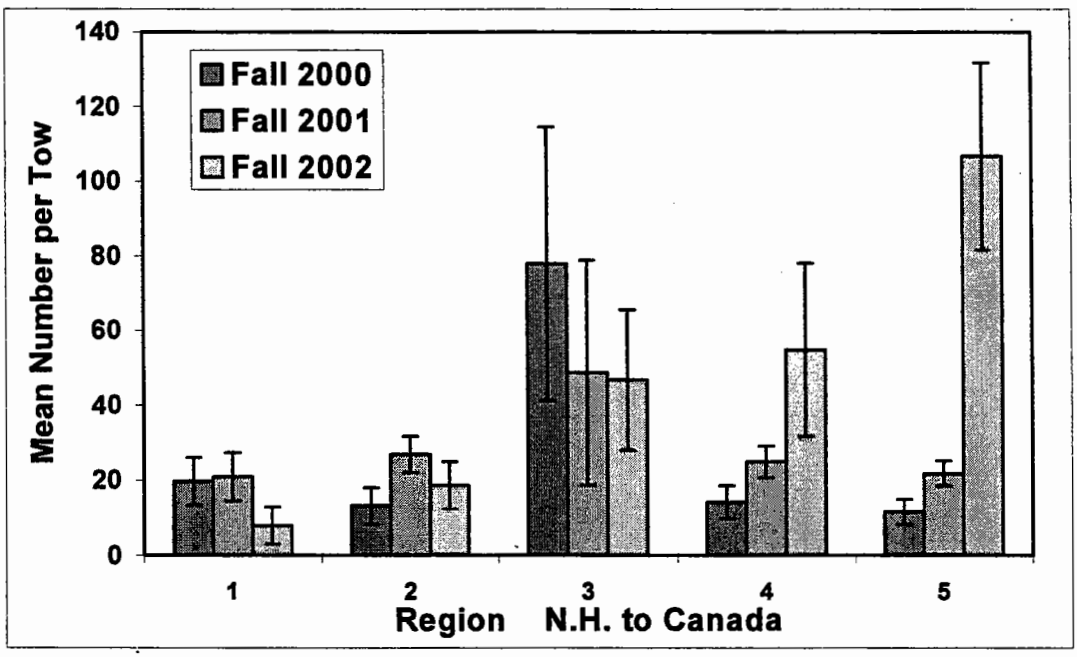


Figure 5. Distribution graphs for longhorn sculpin (*Myoxocephalus octodecemspinosus)* for the spring and fall seasons.

Ichthyoplankton

In the spring of 2002, 26 plankton tows were done, ranging along the coast from New Hampshire to the Canadian border. Thirty-one tows were completed in the spring of 2003. The goal was to complete two tows on each sampling day, but due to time constraints and fixed gear, that was not always obtained. In the last week of the spring 2003 survey, the plankton net was lost ending spring sample collection.
For 2002, a total of 13 different taxa of larvae were collected, identified, and measured (Table 6a). Eleven kinds of eggs were identified. Some of the more abundant larvae were winter flounder, American plaice, and radiated shanny. A large number of Atlantic seasnail larvae were found along the entire coast as well. American plaice, yellowtail flounder, cunner, and the cod/haddock/witch flounder complex were also well represented in the eggs identified.

For 2003, a total of 17 different taxa of larvae were collected (Table 6b). Ten varieties of eggs were seen although 2 were not identified. More sand lance larvae were seen along the southern part of the survey in 2003 and fewer larvae of winter flounder and plaice. Larvae of several *Liparis sp.* remained common in the samples. The eggs identified were fairly similar in abundance and distribution to the previous year.

Conclusions

With three years of the time series completed, trends are just beginning to emerge (Appendix B). Species such as lobster (Table 5, Figure 24), winter flounder (Table 5, Figure 6), silver hake (Table 5, Figure 20), and herring (Table 5, Figure 22), which have a high abundance and percent occurrence along the survey area, appear to be good candidates for analysis based on this survey. An analysis comparing the consistency of sampling of the lobster population in the Gulf of Maine by the ME/NH inshore survey and the NMFS survey concluded that the inshore survey samples a different portion of the population and advises both surveys should be utilized in future assessments to better represent the total population (Chen et al, in press). Inshore surveys tend to encounter larger numbers of juveniles. Data on species such as cod (Figure 9), white hake (Figure 19), haddock (Figure 11), and goosefish (Figure 13), could be used to supplement the NMFS database by providing trends on pre-recruitment populations.

Although some management groups have already expressed interest in the data collected by the survey, the usefulness of this dataset increases greatly over the long term. Resource assessment is based on years of survey and fisheries data. We remain committed to developing a time series sufficient for fish and shellfish assessment. We also seek to make use of new technology that will ensure the quality and consistency of our sampling techniques, thus warranting the long-term continuation of this project.

References

Bigelow, H.B. and W.C. Schroeder. 1953. Fishes of the Gulf of Maine. Fishery Bulletin of the Fish and Wildlife Service Vol. 53. Washington, D.C.

Burnett, J., L. O'Brien, R. K. Mayo, J. A. Darde, and M. Bohan. 1989. Finfish Maturity Sampling and Classification Schemes Used during Northeast Fisheries Center Bottom Trawl Surveys, 1963-89. NOAA Tech. Memo. NMFS-F/NEC-76

Chen, Y., Sherman, S., Wilson, C., Sowles, J. and Kanaiwa, M. An evaluation of consistency of two fishery-independent survey programs in indexing lobster stock in the Gulf of Maine. 2004. In press

Gosslein, M.G. 1969. Groundfish survey program of BCF Woods Hole. Commercial Fisheries, Review 31 (8-9): 22-35.

Rich, W.H. 1929. Fishing Grounds of the Gulf of Maine. Report of the United States Commissioner of Fisheries, for the Fiscal Year 1929. U.S. Department of Commerce, Bureau of Fisheries. Washington, D.C.